

BALDWIN (J. F.)

THE  
METRIC SYSTEM,

—BY—

J. F. BALDWIN, M. D.,

COLUMBUS,

PROFESSOR OF ANATOMY, COLUMBUS MEDICAL COLLEGE,

*Remarks made*

~~READ~~ BEFORE THE

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[NOTE:—Immediately upon the opening of the session of the Society, a number of *Charts* were suspended, by the Secretary, conspicuously upon the walls of the hall, and a quantity of tracts, entitled: "The Metric System in a Nutshell," and "Why should we Use the Metric System?", were placed by him upon the seats: both the charts and the tracts had been furnished him, with the request that they be thus used, by the Metric Bureau, of Boston, Mass. The Society met, there being an unusually large attendance. The charts were examined, the tracts read. An hour before the close of the last day's session, and while the attendance was probably as full as at any time during the entire session, the following resolution was introduced:

*Resolved:* That the Metric System of weights and measures be hereafter used, in expressing all measurements, in the printed Transactions of this Society; that all members presenting papers be requested to use this system in such papers; and that the individual members be requested to use this system in their practice.

An opportunity for remarks being offered, the writer arose, not to oppose, nor yet to advocate, the system, but simply to present the subject in such a manner that the members might vote intelligently.

At the conclusion of his remarks, which were received by the members with the closest attention, and with repeated indications of approbation, Dr. Hyatt,\* of Delaware, said that he entirely approved of every word that had been spoken: it was just such a speech as he had wanted to have made, and he was satisfied that it was from lack of just such speeches that other State Societies, and the American Medical Association had been led to nominally approve of and adopt this system. Wherever it had been thus adopted, in this country, it had, as he had predicted, brought confusion. He had examined the system for himself, and was opposed to it.

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\*Professor of Materia Medica, Columbus Medical College.

Dr. Herrick,\* of Cleveland, said that he had been highly pleased with the gentleman's remarks; that they were very opportune, and just what he himself had felt like making, but lacked the necessary facts and figures. He moved "that the speaker be requested to embody his remarks in writing, as nearly as may be as he has delivered them, and that the article thus made be printed in the Transactions." This motion was amended by Dr. Pratt, of Mt. Sterling, by adding that "in order that the paper may not be buried in the Transactions, copies be sent by the Secretary to the medical journals, with the request to publish." Amendment, and motion as amended, were both carried unanimously.

The question then being upon the original resolution, it was decided unanimously in the negative; *unanimously*, not merely because no one voted for it, but because every one voted against it.

In compliance with the request of the Society, the following article has been prepared, with a strict adherence to the spirit, and, so far as may be, to the letter of the delivery.]

I wish to occupy your attention but a very few moments. Resolutions similar to the one just offered here, have, as you know, been adopted by the American Medical Association, by a number of State Societies, and by numerous local organizations. We are now asked to adopt the same. Before the vote is taken, however, I wish, in order that each one may vote intelligently, to explain briefly what this system is, and just what is implied in its adoption. In the course of my remarks, I shall frequently draw from a paper on the *Metric System*, in the April number of the *Popular Science Monthly*.

The metric system is based on the *meter*. When the meter was agreed upon as the unit, it was supposed to be, by actual measurement, one ten-millionth of a quadrant of the terrestrial meridian of Paris. The men who had charge of this survey, had the audacity to suppose that their instruments were accurate, and that they could use them with accuracy. They forgot that accuracy is an attribute of Infinity, and not of the finite. The first survey was, as was to have been expected, soon pronounced incorrect, and therefore the meter, being no longer an exact subdivision of anything, lost at once its claims as a scientific standard, and became as much an arbitrary unit as our familiar yard. This unscientific and arbitrary unit equals 39.37079 inches, *plus*. This is the unit of length.

The unit of weight—the *gram*—is the weight of a cubic centimeter (hundredth of a meter) of water. This equals 15.43234874 grains, *plus*.

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\*Professor of Principles of Surgery, Medical Department University of Wooster.

The unit of capacity—the *liter*—is the cube of a decimeter (tenth of a meter). This holds 2.1134908 pints, *plus*.

The unit of space—the *stere*—is a cubic meter, and equals 35.386636 cubic feet, *plus*.

The unit of land measure—the *hectare*—is ten thousand square meters, and equals 2.47114 acres, *plus*.

The commercial unit of weight is the *kilogram* (one thousand grams), and equals 2.20462125 pounds avoirdupois, *plus*.

The significant “*plus*” connected with each of these units, not only shows that there is nothing in common between the two systems, but also serves to indicate the feeling of incompleteness, of uncertainty, of inaccuracy, which must attend all attempts at reducing one into the other. But I will return to this point further on.

Before passing to the consideration of the practical aspect of the question, I wish to speak briefly of its theory: In the first paragraph of one of the tracts, of which you have all received copies, I am quoted as saying that, “In commerce, where we are dealing with large quantities, and where long columns of figures, whether expressing weights, measures, or money, must be added up, and the amount multiplied, divided, or otherwise treated as an arithmetical factor, the metric system is a perfect marvel of elegance and simplicity.” (That the writer of this tract calls me “the most virulently conservative exponent of the vis inertiae of egoism,” is not pertinent to the question. Epithets are not arguments.) This “elegance and simplicity,” however, are due to the decimal character of the system, and not to the meter. But in the writing of prescriptions, each quantity stands by itself and is subject to no further arithmetical processes, and hence even the decimal system here possesses no advantage over the other. Decimals are advantageous in large transactions, but are unnatural in small ones.

We are told that the adoption of this system will “save a full year of the school life of every child.” That statement, gentlemen, I think is one of those glittering generalities which you will find scattered throughout these tracts, and which will not bear rigid scrutiny. The adoption of this system will serve to simplify *Compound Numbers*, and some problems in Mensuration; no more, no less. I have

taught school: many of you have taught school: I have talked with teachers on this subject, and I have only this to say: that, although this is a Boston tract, and I am not prepared to vouch for Boston teachers or Boston pupils, yet, so far as Ohio teachers and Ohio pupils are concerned, one quarter of this time is ample. But suppose it does require a year, what of it? We study Latin and Greek at College for five or six years: not because we expect to use those languages in practical life, but because their study gives us that discipline of mind, that culture and training, which shall serve us so well in after life. I have children that I must educate, and I would not, for the world, deprive them of that "year of school life," which is to develop and train their reasoning faculties by their thorough mastering of Compound Numbers.

Again: this Bureau tells us that.

"In 1860 the foreign business of the United States equalled \$792,000,000. Of this, \$700,000,000 was with nations using the metric system, and that, too, before Germany had adopted it." Yet I find, from the report of the *Chief of the Bureau of Statistics on Commerce*, that our business in that year with Great Britain and her Provinces alone amounted to over \$416,000,000, while in 1878, with a total of \$1,132,000,000, our British transactions alone amounted to over \$630,000,000.

This Bureau tells us that "every civilized nation has adopted it, except Russia and England." Yet from the report of the chief of engineers we learn that Switzerland, Sweden, Denmark, and Austria have not adopted it.

This Bureau tells us that "It is exclusively used by the U. S. coast survey." Yet the Secretary of the Navy reports that the adoption of the system would cause a total loss of all the charts and chart-plates, now in use, and would also prevent that free exchange of charts with England which now exists and which is so essential to our navigators.

This Bureau tells us that "in England it is legalized, and makes annual progress in the British Parliament." Yet by act of Parliament of last winter, the system has been, since January first, not only not legal, but absolutely *il*-legal, in England. This may be progress—real progress, but it is not the kind meant by this Bureau, nor the kind which it loves to herald. Indeed, it will probably not an

nounce this adverse fact at all; any more than, should this society decline to adopt the system, it would candidly publish that fact also.

The truth is, gentlemen, this Metric Bureau seems much more anxious to introduce the system, than to arrive at the mere truth; and we may well look with some degree of suspicion upon the boasted disinterestedness of these notoriously thrifty Bostonians, when we find them founding their strongest arguments on statements that, to say the least, seem carelessly, if not scrupulously, inexact.

*Practically* now, what will be the consequences of the proposed adoption? The consequences so far as the general public is concerned, may be summed up briefly as follows:

1. The new units are not, in most respects, as convenient as our old ones, while the subdivisions are unnatural. We naturally divide into halves, quarters, etc., but never into tenths.

2. Our commercial relations with Great Britain, which are of paramount importance to us, will be seriously interfered with.

3. All our charts and chart-plates, which have been obtained at such an immense outlay, must be thrown aside, and all exchange of charts with England must at once cease.

4. A radical change must be made in the putting up of packages, which are now sold, ready-packed, in pound or ounce, or yard or foot, packages.

5. In manufacture, all our gauges, dies, lathes, screws, augers, chisels, machinery of every description, are made with the inch as the standard. All this must be changed, and at a cost of much money and confusion.

6. But it is land measurements that the most dire confusion will manifest itself. We buy and sell land, by the front foot in cities, by the acre in the country. All our deeds and mortgages must be overhauled, the measurement by chains, &c., rectified, and the contents, in the one case, obtained by dividing the number of acres by 2.47114+ (the hectare,) and, in the other case, the frontage obtained by reducing our present measurements, in feet, to inches, and dividing by 39.37079+ (the meter). Instead of a lot with a frontage of 60 feet, there will be a frontage of 18.287669614 + meters; that "+" repre-

senting a column of figures extending, like Banquo's mirrored descendants, "to the crack o' doom," and furnishing ample ground for many a legal Shylock to hang a case upon.

While this system would answer in the laying out of new lots and farms, the attempt to use it in already settled communities, can but result in inextricable confusion and interminable law suits. Yet all this is implied in the *adoption* of the system.

So much for general considerations, in which all are equally interested. Now for considerations of a more special nature, embracing the medical aspect of the case. It is claimed for this system that its adoption (1) will secure uniformity with the metric nations; (2) will from its so-called greater simplicity—as it has but a single unit, the gram—cause fewer mistakes in writing and filling prescriptions; and (3), according to no less an authority than the N. Y. *Medical Record*, will prove convenient in calculating and altering formulæ.

This last advantage can hardly be regarded as other than fanciful. The formula given, by the journal alluded to, (and which, by the way, is metrically incorrect,) was designed to show how easy it is to alter a metric prescription for an adult into one for a child. Of course they may do these things differently in New York, but we of Ohio, I take it, are not in the habit usually of getting up an elaborate prescription for the head of the house, and then modifying the same for the junior members by the "rule of three."

As to the matter of *uniformity*, we differ from the nations of Continental Europe in language, literature, laws, customs and politics: is it of very grave importance that we shall not differ from them in pharmacy? But in a matter of this kind, it will certainly be considered fair—since we are the ones interested—to resort to the *argumentum ad hominem*:—How many members of the Ohio State Medical Society, or of any other State Society, or even of the American Medical Association, read French or German medical periodicals, or other medical works, in the original? How many will travel in those countries? How many, finally, will know, or care, whether one system or the other

is in use in those countries? We read English and American books and journals, and these use the old system.

This is the practical, and the only correct, way to look at this question: will uniformity benefit the mass of the profession? Will it benefit you and me? Or is this simply another glittering generality, designed merely to catch the unthinking?

Finally, as to the vaunted simplicity of this system:

It has, so far as we as physicians are directly concerned, but a single unit—the *gram*—which, as I have already said, equals 15.43234874 grains, *plus*. This is the unit, whether we prescribe powders or liquids; for, says the German Pharmacopeia, “*Mensuris nunquam, sed semper ponderibus liquorum quantitas indicanda et determinanda est.*” This is the method used by Continental physicians, and is the method which we must use if we would be uniform with them. This is the method advocated by the New York *Record* and by the Boston Metric Bureau. The *Chicago Medical Journal and Examiner*, however, is championing a “system” in which liquids are prescribed by volume instead of weight: while in Philadelphia it is proposed to use a “system” in which all quantities, of both solids and liquids, shall be expressed by *weight*, and then, in order that there may be a certain and assured volume for bed-side administration (in “teaspoonful” and “tablespoonful” doses, etc.), enough simple syrup, or other menstruum, is added to make a certain quantity by *volume*.

We thus have presented to us three different “systems,” each “metric” in name, each, probably, good enough of its kind, yet, altogether, threatening us with a condition of most undesirable confusion.

Again: I have already mentioned the feeling of inexactness which must accompany the attempt to change doses from the old system into the new, owing to the fact that there is nothing in common between the two. We are told that we may regard  $\mathfrak{z}\text{j}$  as equal to 30.00 grams—an error of four per cent.; grs. xv as equal to 1.00 gram—an error of three per cent.; and gr. j as equal to six centigrams (0.06)—an error of eight per cent. This feeling that we are giving *about* so much of each drug, is not a particularly pleasant one.

If we adopt the “system” in use in Europe, we must prescribe everything *by weight*. In writing a prescription,

we determine first the size of the dose we will give, and next the number of doses. The first, multiplied by the second, gives us the amount to be set down in the prescription. It becomes necessary to know the bulk that the mixture will make, in order that we may know how many doses, of a teaspoonful or tablespoonful each, it will make. If the same weight, as an ounce, of all liquids gave us the same bulk, there would be no difficulty in prescribing by weight. But as such is not the case, as the relative weight—the specific gravity—must be taken into account, it becomes necessary to know the specific gravity of each liquid prescribed, in order to prescribe accurately.

For illustration: according to Prof. Maisch—one of the editors of the *National Dispensatory*, the specific gravity of ether is .750; ether fortior, .720; spir. etheris comp., .815; spir. etheris nit., .837; glycerine, 1.25; syrups, 1.317; chloroform, 1.48; while the fluid extracts vary so widely that “no reliable rule can be given for their relative proportion of weight to volume.”

But we are told by these Bureau tracts that “not enough chloroform or ether is included in any one prescription” to do any harm, even if the weight is not considered; while infusions and tinctures (and, presumably, fluid extracts) “may be regarded as identical in weight with water,” and the glycerines and syrups “as one-third heavier.”

These again are glittering generalities; now for a few practical and bare particulars:

The New York *Medical Record*, to the prominent position of which, as a leader among medical journals, I need not allude, some two years ago, strongly advocated the adoption of this system. It gave a formula to illustrate the simplicity of the system, in which, owing to its neglect of this matter of the weight of syrups, *it made an error*, according to this rule of the Bureau—the rule itself, however, being, at least practically, erroneous—*of not less than 33 1/3 per cent.* And this error was made, too, by a writer who had investigated the subject sufficiently to write *four consecutive articles* upon it! If a leader in the profession is liable to thus err in using the system, what will not the rank and file do when they come to use it?

The *Record* regarded 30. grams of syrup as making a fluid ounce; the *Bureau* tells us it takes 40. grams; the

*Chicago Medical Journal and Examiner*, in its standing head, tells us it takes 43. grams. Now how is *this*, practically? I have tested the syrups, as prepared for dispensing by six of the principal druggists of Columbus, taking four syrups in each case, and I found that the heaviest specimen weighed  $39\frac{1}{4}$  grams to the ounce, and the lightest  $33\frac{3}{4}$  grams; the average weight being 36.6 grams. The extremes were found in the same syrup—tolu. So, if we of Columbus adopt the *Bureau* rule, we have an error of nearly 10 per cent., while the *Chicago* rule would cause an error of  $17\frac{1}{2}$  per cent.

In truth, gentlemen, the degree of ignorance betrayed by, at least some of, those who are "adopting" this system, is marvelous, is pitiable, is disgraceful. Thus the *New Orleans Medical and Surgical Journal* tells us that:

"In future, *The Medical Tribune* will employ the metric system in its formulas and calculations. The civilized world has generally adopted it, and we propose to continue with that class of the human race. It is high time to do away with the scruples, drachms and ounces, and the confusing ciphers (  $3\bar{5}$  ) of apothecaries' weight. The unit of weight is the gram, equivalent to 15.433 grains. The half-dime token (nickel) weighs a gram, and is a *metre* (39.369 inches) in diameter. Contributors reporting cases or formulas, will help us by conforming to the new scale."

The Toledo *Medical and Surgical Journal* <sup>copies</sup> this without a word of comment.

We have here then the humiliating spectacle of <sup>three</sup> ~~three~~ medical journals telling us that the familiar "nickel" is *over a yard* in diameter, and that it weighs 15 grains (+); when, as a matter of fact, it weighs almost exactly *five times fifteen grains*. Suppose some doctor or druggist should undertake to dispense some powerful drug, using the nickel at a gram weight! Perhaps some of these erudite editors, who have done away with the old familiar "confusing ciphers," have already tried it. If so, they should give us the benefit of their experience.

One patient has been already killed by this system—grams of laudanum being dispensed when centigrams had been prescribed; and a prominent Broadway [N. Y.] drug store put up in four powders, six *decigrams* of morphia, instead of six *centigrams* as written—making each powder

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contain  $2\frac{1}{2}$  grains, instead of  $\frac{1}{4}$  grain. Fortunately, the doctor discovered the mistake.

Two years ago I wrote; "The adoption of the metric system will give us confusion worse confounded.'" Was I, or was I not, correct?

But, you may ask, are not these objections largely theoretical; and will we not, as we come to use the system, find all the objections to vanish, and that the system is really as simple as its advocates would have us think it is?

I reply; I have used the metric system, as it is used in Europe—prescribing everything by weight, for over a year. How many prescriptions I have written in it, I do not know. I am, I believe, the only physician in Columbus who uses it, and about a dozen of the principal druggists have felt the necessity of supplying themselves with the weights; which they have, in most if not all cases, obtained from this thrifty bureau.

During this time, I have made no mistakes in the writing of prescriptions: several errors have occurred in the filling, but none of a serious nature.

The principal trouble I have had has been in the feeling of uncertainty when prescribing liquids, as to what would be the bulk of the resulting mixture. The familiar "*q. s. ad —*," of the old method, sufficed to make the mixture equal a certain bulk: but the new system, at least as used in France and Germany, has no such convenient device. Not only does the difference in specific gravity lead to inaccuracy, but the various solids that are added also effect the bulk, to a greater or less degree: so that it is impossible to predict, with anything like the degree of accuracy desired, the amount of medicine the patient will get.

This inaccuracy may be but a mere *bagatelle* to the visionary and transcendental Bostonian, but to myself it has always been a source of very uncomfortable solicitude, and I judge that I am not alone in this, since our friend Dr. X. C. Scott,\* of Cleveland, who I am sorry was called home suddenly last evening, told me in conversation yesterday that after using the metric system for three years, while pursuing his studies in Europe, he was glad to return to a country where he could use the more reliable methods of the old system.

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\* Professor of Ophthalmology, Cleveland Medical College.

If we adopt the *Chicago* metric system, and use cubic *centimeters* for all liquids, the objection on the ground of inaccuracy will no longer hold. But this method will at once destroy that uniformity with Europe, which, to my mind, constitutes the only real argument, weak as it is, in favor of this system.

So far as my experience goes, then, the metric system possesses no advantage over our old method of writing prescriptions, (save the scarcely tangible one of uniformity with Europe,) while it does possess several manifest and even obtrusive disadvantages.

In conclusion, gentlemen, I thank you for the close attention which you have given me, and for the manifest interest you take in this matter. I do not want to be regarded as an advocate: what I have said I have tried to say in all fairness. I want merely that you shall vote intelligently on this question.

Let resolutions, relating to some matter about which the members know little, and, therefore, to which they feel no special or personal opposition, be presented to any convention, in a neat, well turned, plausible speech, and the chances are a thousand to one that those resolutions will be "adopted" unanimously. I, therefore, want discussion, fair and earnest, that whatever action *this* Society takes, we may be able to defend it.

The question is fairly before you. Will you abandon the old system, which has stood the test of a thousand years, or will you not? Will you adopt the new system, which, as spasmodically and hastily "adopted" by other bodies, is bringing such confusion, or will you not? Or will you, finally, await the action of some calm, deliberative, authoritative body—such as the Pharmacopeial Convention—which shall decide what is best, and, if a change shall seem desirable, when and how it shall be accomplished? Says Bacon, "Stand upon the ancient way, and look about to discover what is the best way."





